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10/516,742

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Suk Hun Lee

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10/10/2006

BIRCH STEWART KOLASCH & BIRCH
PO BOX 747
FALLS CHURCH, VA 22040-0747

EXAMINER

LEE, CHEUNG

ART UNIT

PAPER NUMBER

2812

DATE MAILED: 10/10/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/516,742

Applicant(s)

LEE, SUK HUN

Examiner

Cheung Lee

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 19 July 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7, 10 and 11 is/are rejected.
- 7) ☒ Claim(s) 8, 9 and 12-15 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Notice to Applicant

1. Applicant's Amendment and Response to the Office Action mailed on April 19, 2006 has been entered and made of record.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1 and 7 are rejected under 35 U.S.C. 102(e) as being anticipated by Shakuda (US Pub. 2002/0125492).

Referring to figures 1(a)-6 and related text, Shakuda discloses [Re claims 1 and 7] a method for fabricating a nitride semiconductor, the method comprising the step of: (a) growing a GaN-based buffer layer (23, 24) formed on a substrate 21 in any one selected from a group consisting of a three layered structure $Al_yIn_xGa_{1-(x+y)}N/In_xGa_{1-x}N/GaN$ where $0 < x \leq 1$ and $0 \leq y \leq 1$, a two-layered structure $In_xGa_{1-x}N/GaN$ where $0 \leq x \leq 1$ (page 3, paragraph 38; page 5, paragraph 83), and a superlattice structure of $In_xGa_{1-x}N/GaN$ where $0 < x \leq 1$, the two-layered structure will be GaN/GaN when $x = 0$, Shakuda discloses low-temperature GaN 23/high-temperature GaN 24 for buffer layer,

so the claimed limitation is met; and (b) growing a GaN-based single crystalline layer 25 (page 2, paragraph 27; page 3, paragraph 39) on the grown GaN-based buffer layer (see fig. 1(b)).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 2-3 and 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shakuda, as applied above, and in view of Kano et al. (US Pub. 2001/0035531; hereinafter "Kano").

4. [Re claims 2 and 10] Shakuda fails to disclose expressly wherein the step (b) comprises the step of: growing an indium-doped GaN layer; growing an undoped GaN layer on the indium-doped GaN layer; and growing a silicon-doped n-GaN layer on the undoped GaN layer.

Referring to figures 1-11 and related text, Kano discloses an InGaN/AlGaIn layer 50; an undoped GaN layer 6 (page 6, paragraph 87) formed on the InGaN/AlGaIn layer; and a silicon-doped n-GaN layer 7 (page 7, paragraph 97, Table 2) formed on the undoped GaN layer.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to use doped and undoped layers before n-GaN layer, as taught by Kano,

because it would have been to reduce lattice defects and to improve crystallinity (Kano, page 3, paragraph 42).

5. [Re claims 3 and 11] Shakuda fails to disclose expressly wherein the step (b) comprises the step of: growing an undoped GaN layer; growing an indium-doped GaN layer on the undoped GaN layer; and growing a silicon-doped n-GaN layer on the indium-doped GaN layer.

Referring to figures 1-11 and related text, Kano discloses an undoped GaN layer 3; an InGaN/AlGaIn layer 30 formed on the undoped GaN layer; and a silicon-doped n-GaN layer 7 (page 7, paragraph 97, Table 2) formed on the indium-doped GaN layer. The motivation stated in claims 2 and 10 also applies.

6. Claims 4-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Doverspike et al. (US Pat. 6459100; hereinafter "Doverspike") in view of Shakuda.

7. Referring to figure 1 and related text, Doverspike discloses [Re claim 4] a nitride semiconductor light emitting device comprising: a substrate 11; a GaN-based buffer layer 13 formed on the substrate; a first electrode layer of an n-GaN layer 20 formed on the GaN-based buffer layer, the silicon-doped n-GaN layer (col. 5, lines 50-55) is first electrode layer as disclosed in the specification; an activation layer 12 formed on the first electrode layer; and a second electrode layer of a p-GaN layer 23 formed on the activation layer, the Mg-doped p-GaN layer (col. 5, lines 55-65) is second electrode layer as disclosed in the specification. However, Doverspike fails to disclose expressly wherein the GaN-based buffer layer formed on the substrate in any one selected from a

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group consisting of a three layered structure $\text{Al}_y\text{In}_x\text{Ga}_{1-(x+y)}\text{N}/\text{In}_x\text{Ga}_{1-x}\text{N}/\text{GaN}$ where $0 < x \leq 1$ and $0 \leq y \leq 1$, a two-layered structure $\text{In}_x\text{Ga}_{1-x}\text{N}/\text{GaN}$ where $0 \leq x \leq 1$, and a superlattice structure of $\text{In}_x\text{Ga}_{1-x}\text{N}/\text{GaN}$ where $0 < x \leq 1$.

Referring to figures 1(a)-1(f) and related text, Shakuda discloses a GaN-based buffer layer (23, 24) formed on a substrate 21, the GaN-based buffer layer comprises low-temperature GaN 23/high-temperature GaN 24. When $x = 0$, the claimed two-layered buffer structure will be GaN/GaN, so the claimed limitation is met.

At the time of the invention it would have been obvious to a person of ordinary skill in the art to use the buffer structure, as taught by Shakuda, because it would have been to minimize and relax the lattice mismatch efficiently (Shakuda, page 2, paragraph 28).

8. Doverspike discloses [Re claim 5] wherein further comprising: an Indium-doped GaN layer 12 formed on the GaN-based buffer layer; and an undoped GaN layer 15 formed on the Indium-doped GaN layer (see fig. 1).

9. Doverspike discloses [Re claim 6] wherein further comprising: an undoped GaN layer 14 formed on the GaN-based buffer layer; and an Indium-doped GaN layer 12 formed on the undoped GaN layer (see fig. 1).

Allowable Subject Matter

10. Claims 8-9 and 12-15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: claims 8, 12 and 14 recite the GaN-based buffer layer is grown by introducing sources of TMGa, TMIn and TMAI and a gas of NH_3 at the same time while supplying carrier gases of H_2 and N_2 . This feature in combination with the other elements of the claims are neither disclosed nor suggested by the prior art of record.

Claims 9, 13 and 15 variously depend from claims 8, 12 or 14, so they are objected for the same reason.

Response to Arguments

11. Applicant's arguments with regard to the rejection under 35 U.S.C. 102(e) or 103(a) have been fully considered, but they are not deemed to be persuasive for at least the following reasons.

12. Applicant argued that Shakuda fails to suggest or disclose either a $\text{Al}_y\text{In}_x\text{Ga}_{1-(x+y)}\text{N}$ layer or a $\text{In}_x\text{Ga}_{1-x}\text{N}$ layer for the buffer layer 23, 24. However, the claims disclose that a two-layered structure $\text{In}_x\text{Ga}_{1-x}\text{N}/\text{GaN}$ where $0 \leq x \leq 1$ can be selected for GaN-based buffer layer. When $x = 0$, the claimed two-layered buffer structure will be GaN/GaN, and Shakuda discloses low-temperature GaN 23/high-temperature GaN 24 for buffer layer, which is two-layered GaN/GaN buffer structure. Therefore, the claimed limitation is met.

13. Applicant also argued that Kano fails to suggest either a $\text{Al}_y\text{In}_x\text{Ga}_{1-(x+y)}\text{N}$ layer or a $\text{In}_x\text{Ga}_{1-x}\text{N}$ layer. Note that applicant's argument is largely directed to what the cited reference teaches individually. However, it is axiomatic that one cannot show

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nonobviousness by attacking references individually where the rejection, as here, is based on a combination of references. *In re Young*, 403 F.2d 754, 159 USPQ 725 (CCPA 1968); *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). For example, applicant argued that Kano does not disclose a $\text{Al}_y\text{In}_x\text{Ga}_{1-(x+y)}\text{N}$ layer or a $\text{In}_x\text{Ga}_{1-x}\text{N}$ layer. However, Shakuda (see argument stated above), not Kano, is employed in the rejection to show that feature of the claimed process.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Cheung Lee whose telephone number is 571-272-5977. The examiner can normally be reached on Monday through Friday from 8:30AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Lebentritt can be reached on 571-272-1873. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Cheung Lee

September 29, 2006


MICHAEL LEBENTRITT
SUPERVISORY PATENT EXAMINER